

- (iii) Because the receiver display is progressively scanned, resulting in a high resolution image, the conventional line structure or static raster, which is clearly visible on large-screen NTSC displays, is largely eliminated.
- (iv) The two-dimensional spectral distribution and corresponding refresh rates of HDMAC-60 result in a picture free of motion artifacts with full HDTV resolution in both the horizontal and vertical directions. High diagonal detail, apparent in still pictures, is slightly reduced resulting in a flicker-free picture; however, psycho-visual studies indicate that diagonal resolution is less important than horizontal or vertical resolution, and a slight loss of diagonal resolution is unlikely to be objectionable.^{45/} We believe that the balanced distribution of detail, both spatially and temporally, in HDMAC-60 is well suited to the human visual system. HDNTSC, derived from HDMAC-60, is similarly free of motion artifacts with full HDTV resolution in both vertical and horizontal directions.
- (v) In addition to HDTV resolution, HDS-NA offers a wide aspect ratio display (16:9) picture with the effect of 35 millimeter movies, and high spatial and temporal resolution which give the effect of space and depth. To enhance the viewing experience, CD-quality digital sound wraps the viewer in high fidelity.
- (vi) High definition temporal resolution is accomplished without frame store, multi-frame signal processing or subsampling techniques in the television receiver.
- (vii) Most important, HDS-NA is NTSC compatible. The main signal of HDNTSC is a pure NTSC signal (525-line, 2:1 interlaced scan with a 59.94 Hz field rate) that is compatible with conventional NTSC broadcast and reception equipment. A viewer with any vintage NTSC television set,

^{45/} If one thought it necessary, this diagonal resolution could be recaptured by the receiver using picture memory. This would result in minor high-diagonal-resolution motion artifacts.

color or monochrome, can receive a non-degraded NTSC picture via HDNTSC terrestrial broadcast without any additional investment in conversion or decoding equipment.^{46/} [¶¶28, 37, 38; 40-Q5 and 81]

4.5 The Economic Costs Associated With HDS-NA Appear Reasonable

The costs for transmission and modulation techniques used to achieve an HDTV spectrum plan should be reasonable in the same way that the costs for establishing color television were reasonable (compared to the costs of monochrome) when color was first introduced. In this regard, we believe that the spectrum and economic choices associated with the transmission and reception of high definition television using HDS-NA will be reasonable compared to the costs for NTSC color television.

New studio equipment, including cameras, tape recorders, mixers, telecine machines, and the like, will be required for HDTV regardless of the production or broadcast standard adopted. Similarly, when program material is transmitted to a satellite, the signal will have to be encoded. Encoders will be relatively inexpensive compared to the cost for studio equipment.

^{46/} This is equally true for cable distribution. For HDTV broadcast via direct broadcast satellite using HDMAC-60, compatibility is provided with a non-complex consumer-level transcoding device in the viewer's satellite signal receiver.

At the broadcast satellite, HDS-NA is cost efficient. With a bandwidth of only 24 MHz, HDMAC-60 can be transmitted using one satellite transponder.

When the satellite signal is received at the terrestrial broadcast station CATV headend or DBS receiver, a decoder will be needed to convert the HDMAC-60 signal into its 2-channel HDNTSC distribution format. Because HDMAC-60 and HDNTSC are designed around common parameter values, transcoding between them is relatively easy and the cost of decoder equipment is expected to be modest. Only in the case of DBS is the cost of a decoder repeated on a pre-user basis.

A part of the costs associated with the HDNTSC distribution signal will depend upon the spectrum plan adopted. We expect that two transmitters will ultimately be necessary, and whether multi-component antennas will be recommended will depend upon the frequency separation between the main channel and the augmentation channel. Of all the costs associated with HDTV, the quantification of the costs that depend on the particular spectrum plan adopted are the least well developed. We encourage the Commission to provide a forum in conjunction with the work

of the Advanced Television Systems Committee and industry associations to help develop these costs. [1140-Q4 and 50-Q9]

4.6 The Pace of HDS-NA Development Is Quickening

The pace of HDS-NA development at North American Philips, and, in fact, the pace of HDTV development in the United States has quickened as the potential of HDTV comes closer to realization and the excitement of the technological opportunity grows. Less than two years ago, HDTV was a subject only among TV engineers and scientists. Today it is a subject for the public at large.

At North American Philips, our HDTV work is progressing rapidly. Both the satellite transmission signal (HDMAC-60) and the distribution signal (HDNTSC) of our high definition system for North America (HDS-NA) have been designed. This past April, we conducted demonstrations of HDNTSC in baseband and in a simulated CATV environment duplicating normal modulator and demodulator

techniques. The NAPC demonstrations showed our system at an early stage of development, and were held less than two years after we began our work. Since April, the pace has become faster. Full high definition horizontal resolution has been added to the system, and the scope of our work has been broadened to include intensive studies of mechanisms for terrestrial emission. To date these studies indicate excellent potential, but they must be developed and affirmed with field experiments. Baseband demonstrations of the full HDS-NA system are expected in the summer of 1988. We envision transmission demonstrations as part of the efforts of the Advanced Television Systems Committee, the National Association of Broadcasters, the Association of Maximum Service Telecasters, the National Cable Television Association and others, with the focus on providing information to the Commission in connection with ATV rulemaking proceedings. [W40-Q3]

5. THE TRADEOFFS AMONG PICTURE QUALITY, SPECTRUM,
COMPATIBILITY AND EQUIPMENT COMPLEXITY/COST WEIGH IN
FAVOR OF ADDITIONAL SPECTRUM FOR HDTV

5.1 Determining the Tradeoffs

Defining integrated standards for ATV in the United States requires measuring the advantages and disadvantages of various proposals against the characteristics of a target system. The principal characteristics of the target system are its picture quality, spectrum needs, receiver compatibility and equipment complexity/costs. As related in these comments, North American Philips has selected criteria for each of these characteristics:

- (i) HDTV, including high definition resolution, a wide aspect ratio display and digital CD-quality sound, should be the goal for ATV in the United States. Intermediate (EDTV) standards can occupy the continuum between NTSC and HDTV, but must be both forward compatible to HDTV and backward compatible to NTSC.
- (ii) HDTV must be receiver compatible with NTSC.
- (iii) Terrestrial emission of HDTV must be spectrum efficient.
- (iv) The equipment complexity and economic costs associated with HDTV implementation must be reasonable in the same way as were the complexity and costs for implementing color TV.

Balancing the above criteria, we have concluded that the target system will require and deserves more than 6 MHz of rf spectrum per licensee for HDTV implementation. We urge

the Commission to adopt the same criteria in its ATV deliberations, to preserve the rf spectrum for HDTV, and, at the appropriate time, to assign the additional spectrum needed. This country should not accept as a final goal an EDTV or IDTV implementation that fits into a 6 MHz bandwidth. The American public should not be denied the HDTV viewing experience that will become available in both Europe and Japan.

We believe that HDS-NA holds excellent promise for meeting the criteria described above. However, the process for determining the ultimate standard is not unilateral. It must be done within the television industry. [¶¶39 and 40-Q1]

5.2 Reconciling the Tradeoffs Within the Industry

We believe that the best way to accomplish integrated HDTV standards is through industry cooperation and consensus building. Although this approach places a heavy burden on system proponents, we believe that they are capable of meeting the task. For its part, North

American Philips is committed to sharing information with the industry, seeking cooperation in appropriate ways and building consensus. We have published a series of technical articles describing various portions of HDS-NA. We have been active in the Advanced Television Systems Committee and the U.S. CCIR Working Groups. We have participated in the NTIA industry panel and have testified before Congress with respect to ATV. We have hosted major technology demonstrations for both government and industry. Our goal has been the development of an HDTV system that meets the needs of the industry and the public within the constraints described in these comments. If that system is not ours, in whole or in part, because another HDTV proposal has greater merit, we will endorse that proposal.

Systems consensus opportunities are being put in place. The Advanced Television Systems Committee, in coordination with the National Association of Broadcasters HDTV Project Office, and the Association of Maximum Service Telecasters will be developing test plans,

constructing facilities and conducting system testing. Baseband and rf evaluations will also be critical, and in later stages of development, joint demonstrations and side-by-side comparisons, run and judged by the industry, will be constructive. Broad participation with industry groups such as the National Cable Television Association HDTV Committee, and the Society of Motion Picture and Television Engineers will further focus the objectives of the industry. We look forward to working with these groups.

Finally, the Advanced Television Systems Committee will analyze proposals and issue reports to the Commission. In the end, it will be the Commission, with private sector advice, which will make the ATV decisions in the time-tested environment of its rule-making capacity. We especially look forward to participation in those proceedings.

6. CONCLUSION

The issues which the Notice and our comments have covered are complex. Much work and cooperation will be needed within the industry and by the Commission to navigate a path to HDTV. A first critical step has now

been taken, and we are confident that it will lead to the benefits of HDTV being enjoyed by the American public at large.

Respectfully submitted,
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I hereby certify that on this 18th day of November, 1987, copies of the foregoing Comments of North American Philips Corporation were mailed by first class mail to the individuals on the attached list.

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